

# MINERALS

Minerals are defined as naturally occurring, inorganic, solids with a definite chemical composition and a regular, internal crystalline structure. Each mineral is composed of one or more elements. Different chemical compositions result in different minerals. For instance, the many varieties of garnet have the same crystalline structure, but are composed of different elements. They are each, therefore, different minerals. Different internal crystalline structures result in different minerals. A good example of this is diamond and graphite. Both are composed of carbon, but have different crystalline structures and are different minerals. As a matter of fact, it's the different structure that makes diamond the hardest of minerals and graphite (pencil lead) one of the softest. There are currently about 3000 known minerals.

## PHYSICAL PROPERTIES

Determining the actual chemical composition and crystalline structure of a mineral is difficult without proper equipment and a chemical laboratory. Fortunately, it is these two aspects that determine each mineral's physical properties. These physical properties are what help geologists identify minerals in the field. In addition, with experience, geologists learn that most minerals tend to form in certain environments and rock types. For instance, graphite and molybdenite are very similar in color and hardness, but graphite is almost always found in metamorphic rocks, while molybdenite is almost always found in igneous rocks. The table below describes each physical property that is used to help identify minerals.

PHYSICAL PROPERTY	DEFINITION	TESTING METHOD
Cleavage	Breakage of a mineral along planes of weakness in the crystal structure.	Examine the mineral for areas where the mineral is broken. Look for areas where light reflects from flat surfaces.
Color	The color of a mineral is that part of the spectrum that it reflects	Look at the sample and determine its color.
Crystal Form	Geometric shape of a crystal or mineral	Examine and describe the geometric shape of the mineral if it can be seen.
Fracture	Breakage of a mineral, not along planes of weakness	Examine the mineral for areas where the mineral is broken. Describe the breakage.
Hardness	Resistance to scratching (Mohs 1-10 Hardness Scale)	Scratch the mineral with known hardness items or scratch the items with the mineral until hardness is determined.

Luster	Character of light reflected by the mineral	Look at the sample to determine if the is metallic in appearance or non-metallic.
Specific Gravity	The density of a mineral measured by the ratio of its mass and the mass of an equal volume of water	Hard to determine without laboratory equipment, but can at least be estimated as “heavy” or “light.” 1 is the same as water; 5 is five times heavier than water.
Streak	Color of the mineral when it is powdered	Grind (scratch) a small amount of the mineral on a porcelain streak plate and note the color of the powder.

Other properties include magnetism, reaction to HCl (hydrochloric acid), fluorescence, radioactivity, play of colors, and even taste and/or smell. A few minerals are magnetic, many effervesce (fizz) in acid, some fluoresce under a UV (black) light, a few are radioactive, and a few actually have a taste or smell, especially when freshly broken. Tenacity is a mineral's resistance to breaking or bending.

## **CLEAVAGE**

Cubic, Octahedral, Dodecahedral, Rhombohedral, Prismatic, Pinacoidal

## **FRACTURE**

Conchoidal: Smooth, curved fracture resembling the interior surface of a shell (like a chip in a windshield)

Fibrous or Splintery: Resembles splintered wood

Hackly: Jagged fractures with sharp edges

Irregular: Fractures producing rough and irregular surfaces

## **HARDNESS: Mohs Hardness Scale**

- |             |               |
|-------------|---------------|
| 1. Talc     | 6. Orthoclase |
| 2. Gypsum   | 7. Quartz     |
| 3. Calcite  | 8. Topaz      |
| 4. Fluorite | 9. Corundum   |
| 5. Apatite  | 10. Diamond   |

In addition to this scale:

- Fingernail is a little over 2
- A copper coin is about 3
- A steel knife blade or nail is a little over 5
- Window glass is 5 ½
- A steel file is 6 ½

With a little practice, the hardness of minerals under 5 can be quickly estimated by how easily they are scratched with a pocket knife.

## **TENACITY**

Brittle: A mineral that breaks or powders easily

Malleable: A mineral that can be hammered out into thin sheets

Sectile: A mineral that can be cut into thin shavings with a knife

Ductile: A mineral that can be drawn into a wire

Flexible: A mineral that bends, but does not resume its original shape when pressure is removed

Elastic: A mineral that, after it is bent, resumes its original shape when pressure is removed

## **LUSTER**

Metallic (metallic minerals are usually dark colored, opaque, and have a dark streak)

Non-metallic

Vitreous: The luster of glass

Resinous: Having the luster of resin (wax)

Pearly: An iridescent pearl-like luster

Greasy: Appears as if covered with a thin layer of oil

Silky: Silk-like

Adamantine: A hard brilliant luster like that of a diamond